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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/630,444 | 07/29/2003 | Kenichi Koyanagi | P/3236-39 | 7918 |

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| EXAMINER | |
|---|---|
| COLEMAN, WILLIAM D | |
| **ART UNIT** | **PAPER NUMBER** |
| 2823 | |

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
|---|---|---|
| 3 MONTHS | 01/29/2007 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/630,444 | KOYANAGI ET AL. | |
| | Examiner | Art Unit | |
| | W. David Coleman | 2823 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on 29 November 2006.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) 1-37 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1,3-17,19,21-25,27-35 and 37 is/are rejected.

7)☒ Claim(s) 2,18,20 and 36 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on November 29, 2006 has been entered.

### *Response to Arguments*

2. Applicant's arguments filed October 20, 2006 have been fully considered but they are not persuasive.

3. Applicants contend that the prior art reference Boku et al., JP 09-121035 herein known as Boku does not completely form a metal oxide film because Boku discloses that the oxide film of metal is formed in more than one step by repeating carrying out the first and second steps one or more times.

In response to Applicants contention that Boku fails to teach Applicants invention because Boku includes the term “one or more” it does not preclude Boku of completely forming a metal oxide film once before annealing and therefore Applicants argument is moot.

### *Claim Rejections - 35 USC § 102*

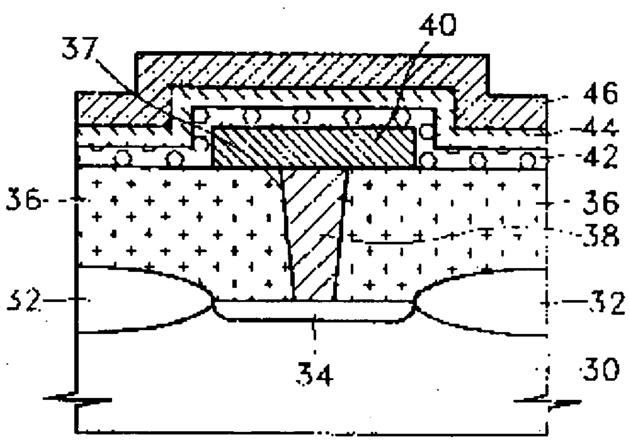
1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 19, 21, 22, 23, 24, 25,26, 27, 28, 31, 32, 33, 34, 35 and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Boku et al., Patent Abstracts of Japan 09-121035.

Boku discloses a semiconductor process as claimed. See Drawings 1-12 for the following limitations.




3. Pertaining to claim 1, Boku teaches a method for manufacturing a semiconductor device, comprising a dual-stage deposition step comprising:

a first stage for introducing a material gas containing

desired metal (i.e., tantalum pentaethoxy, see paragraph [0009] where Boku uses the term "pentaethoxy-tantalum" (Ta5(OC two H5)) as the ingredient) into a reaction chamber in which a semiconductor substrate **30** on a surface of which a metal film **40** is formed in part or in entirety is placed to thus form an oxide film made of said specified metal by a vapor-phase growth method and, after completion of the first stage, the following second stage for removing from said reaction chamber said material

gas introduced into said reaction chamber at said first stage and a byproduct produced at said first stage, and wherein said metal oxide film as an oxide of said specified metal is formed on said semiconductor substrate, by repeating said dual-stage deposition step two or more times (because the oxide layer are distinct different layers i.e., 42 and 44 it is clear that distinct deposition processes separate the two layers of dielectric grown material), and

wherein when said metal oxide film is completely formed, said semiconductor substrate is annealed (because Boku teaches at least one time, this limitation has been met).

4. Pertaining to claim 3, Boku teaches the method according to claim 1, wherein said material gas and said byproduct produced at said first stage are removed by introducing a different from said material gas at said first stage into said reaction chamber at said second stage (please note that CVD chamber comprise vacuum pumps which are continuously running during a deposition process. Once a process step ends the vacuum chamber will inherently be depressurized due to diminishing material gas in the chamber from one process to the next).

5. Pertaining to claim 4, Boku teaches the method according to claim 1, wherein said material gas and said by product produced at said first stage are removed by depressurizing said reaction chamber at said second stage (please see the explanation of claim 3 above to address the issue of the present claim which are well known in the CVD process).

6. Pertaining to claim 5, Boku teaches the method according to claim 4, wherein after having performed said depressurizing at said second stage, and before said first stages starts in a next dual-stage deposition step, a gas different from said material gas is introduced into said reaction chamber to thus recover a gas pressure before performing said depressurizing in said reaction chamber (please note that since Boku teaches a four step process, these steps and be divided into two stages having two steps each to form the dielectric film for a semiconductor trench capacitor).

7. Pertaining to claim 6, Boku teaches the method according to claim 1, wherein said metal oxide film having a finally required film thickness is formed by repeating said steps a plurality of number of times (please see Abstract where the process of forming a $Ta_2O_5$ is formed and an annealing step is repeated one or more times).

Pertaining to claim 7, Boku teaches the method of claim 1, wherein after said steps are repeated a plurality of number of times, said material gas is introduced continuously to a time longer than that required for said first stage, to form said metal oxide film having the finally required film thickness (please note that this is done during the annealing step with ozone ($O_3$)).

8. Pertaining to claim 8, Boku teaches the method according to claim 1, wherein an oxidizing gas is introduced at said first stage (see paragraph [0009]).

9. Pertaining to claim 9, Boku teaches the method according to claim 8, wherein introduction of said oxidizing gas is started from a second-time said steps (see paragraph [0010]).

10. Pertaining to claim 13, Boku teaches the method according to claim 1, wherein said metal film is made of metal having a catalytic action (it is well known that tantalum pentaethoxy contains a catalyst).

11. Pertaining to claim 14, Boku teaches the method according to claim 1, wherein said vapor-phase growth method is a chemical vapor deposition method or a physical vapor deposition method (please see paragraph [0009] where Boku teaches a CVD method).

12. Pertaining to claim 15, Boku teaches the method according to claim 1, wherein said metal oxide film as said oxide of said specified metal is made of at least one selected from the group consisting essentially of tantalum, hafnium, zirconium, and niobium (Boku teaches the metal tantalum).

13. Pertaining to claim 16, Boku teaches the method according to claim 15, wherein tantalum penta-ethoxide is used as said material gas (please see the rejection of claim 13 above).

14. Pertaining to claim 17, Boku teaches the method according to claim 8, wherein a said

oxidizing gas, a gas containing oxygen, ozone, water, nitrogen, oxide, or oxygen radical is used (please see paragraph [0010] where ozone (i.e., $O_3$) is used in the process).

15. Pertaining to claim 19, Boku teaches a method for manufacturing a semiconductor device having a capacitor, comprising:

a dual stage step comprising:

a first stage for introducing a material gas (see paragraph [0009] where Boku teaches using a pentaethoxy-tantalum gas) containing an oxide of a desired metal into a reaction chamber in which a semiconductor substrate **30** on a surface of which a metal film **40** is formed in part or in entirety is placed to thus form an oxide film made of said desired metal by a vapor-phase growth method and, after completion of the first stage, the following second stage for removing from said reaction chamber said material gas introduced into said reaction chamber at said first stage and a byproduct produced at said first stage (the Examiner takes the position that since Boku uses ozone in an annealing step after depositing the first oxide film, the chamber is inherently pumped to remove the ozone before repeating growing the second insulative film on the first insulative film), and

wherein said metal oxide film as an oxide of said specified metal is formed on said semiconductor substrate, by repeating said dual stage deposition step tow or more times, thereby forming a capacitive insulating film to make up said capacitor;

annealing said semiconductor substrate when said capacitive insulating film is completely formed; and

forming an upper electrode to make up said capacitor on said capacitive insulating film ; annealing said semiconductor substrate when said capacitive insulating film (please also see the rejection of claim 1 above)

16. Pertaining claim 21, Boku teaches the method according to claim 19, wherein said material gas and said by product produced at said first stage are removed by introducing a gas different from said material at said first stage into said reaction chamber at said second stage (please note that ozone is different than pentaethoxy-tantalum for the anneal step).

17. Pertaining to claim 22, Boku teaches the method according to claim 19, wherein said material gas and said byproduct at said first stage are removed by depressurizing said reaction chamber at said second stage (please note that CVD chamber comprise vacuum pumps which are continuously running during a deposition process. Once a process step ends the vacuum chamber will inherently be depressurized due to diminishing material gas in the chamber from one process to the next).

18. Pertaining to claim 23, Boku teaches the method according to claim 22, wherein after having performed said depressurizing at said second stage and before said first stages tarts in a next dual-stage deposition step, a gas different from said material gas is introduced into said reaction chamber to thus recover a gas pressure before performing said depressurizing in said reaction chamber (please note that $OC_2H_5$ is different from $O_3$ and further as explained in claim 22 above the claimed process is inherent).

19. Pertaining to claim 24, Boku teaches the method of claim 9, wherein said metal oxide film having a finally required film thickness is formed by repeating said steps a plurality of number of times (please see Abstract).

20. Pertaining to claim 25, Boku teaches the method according to claim 19, wherein after said steps are repeated a plurality of number of times, said material gas is introduced continuously for a time longer than that required for said first stage, to form said metal oxide film having the finally required film thickness (because the film is annealed in an ozone ($O_3$) environment this limitation has been met).

21. Pertaining to claim 26, Boku teaches the method according to claim 19, wherein an oxidizing gas is introduced at said first stage (the Examiner takes the position that $OC_2H_5$ is an oxidizing gas).

22. Pertaining to claim 28, Boku teaches the method according to claim 19, wherein said second stage comprises a process for introducing an oxidizing gas and a process gas for introducing said material gas and a different from said oxidizing gas (please note that since Boku teaches a four step process, these steps and be divided into two stages having two steps each to form the dielectric film for a semiconductor trench capacitor).

23. Pertaining to claim 31, Boku teaches the method according to claim 19, wherein said metal film is made of metal having a catalytic action (this is inherent since only $Ta_2O_5$ is the end result of the process gases during fabrication of the capacitor dielectric).

24. Pertaining to claim 32, Boku teaches the method according to claim 19, wherein said vapor-phase growth method is a chemical vapor deposition method or a physical vapor deposition method (please note that Boku teaches both methods, see column [0009]).

25. Pertaining to claim 33, Boku teaches the method according to claim 19, wherein said metal oxide film as said oxide of said specified metal is made of at least one selected from the group consisting essentially of tantalum, hafnium, zirconium, and niobium (please note that Boku teaches tantalum).

26. Pertaining to claim 34, Boku teaches the method according to claim 33, wherein tantalum penta-ethoxide is used as said material gas (please see paragraph [0009]).

27. Pertaining to claim 35, Boku teaches the method according to claim 26, wherein as said oxidizing gas, a gas containing ozone, water, nitrogen oxide or oxygen radical is used (it is well known that ethoxide is an oxygen radical).

28. Pertaining to claim 37, Boku teaches a method for manufacturing a semiconductor device, comprising the steps of:

a first stage for introducing a material gas containing an oxide of a desired metal into a reaction chamber in which a semiconductor substrate on a right side of which a metal film is formed is placed to thus form an oxide film made of said desired metal by a vapor-phase growth method and, after completion of the first stage, the following second stage for removing from said reaction chamber said material gas introduced into said reaction chamber at said first stage and a byproduct produced at said first stage and, after completion of the second stage then introducing said material gas continuously for a lapse of time longer than said first stage, thereby forming an oxide film made of said metal having a finally required film thickness (please see the rejection of claims 1 and 19 above since the present claim is merely a variation of claims 1 and 19), and

annealing said semiconductor substrate when said oxide film of said metal is completely formed.

## *Claim Rejections - 35 USC § 103*

29. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

30. Claims 11, 12, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boku, Japanese Patent Abstract Publication 09-121035 in view of Kukli et al., "Atomic layer

Deposition and Chemical Vapor Deposition of Tantalum Oxide by Successive and Simultaneous Pulsing of Tantalum Ethoxide and Tantalum Chloride" Chemical Materials, vol. 12, published in 2000, pp 1914-1920.

31. Pertaining to claim 11, Boku fails to teach the method of claim 3, wherein said gas different from said material gas is an inactive gas. Kukli teaches the inactive gas to be nothing more than a nitrogen which is a carrier gas for $TaOC_2H_5$. In view of Kukli, it would have been obvious to one of ordinary skill in the art to incorporate nitrogen into the Boku semiconductor process to grow $Ta_2O_5$ films (see the Experimental Section first paragraph of Kukli).

32. Pertaining to claim 12, Boku fails to teach the method of claim 11, wherein said inactive gas is a nitrogen gas. Kukli teaches the inactive gas to be nothing more than a nitrogen which is a carrier gas for $TaOC_2H_5$. In view of Kukli, it would have been obvious to one of ordinary skill in the art to incorporate nitrogen into the Boku semiconductor process to grow $Ta_2O_5$ films (see the Experimental Section first paragraph of Kukli).

33. Pertaining to claim 29, Boku fails to teach the method of claim 21 wherein said gas different from said material gas is an inactive gas. Kukli teaches the inactive gas to be nothing more than a nitrogen which is a carrier gas for $TaOC_2H_5$. In view of Kukli, it would have been obvious to one of ordinary skill in the art to incorporate nitrogen into the Boku semiconductor process to grow $Ta_2O_5$ films (see the Experimental Section first paragraph of Kukli).

34. Pertaining to claim 30, Boku fails to teach the method of claim 29, wherein said inactive gas is a nitrogen gas. Kukli teaches the inactive gas to be nothing more than a nitrogen which is a carrier gas for $TaOC_2H_5$. In view of Kukli, it would have been obvious to one of ordinary skill in the art to incorporate nitrogen into the Boku semiconductor process to grow $Ta_2O_5$ films (see the Experimental Section first paragraph of Kukli).

### *Objections*

35. Claims 2, 18, 20 and 36 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

### *Conclusion*

36. Any inquiry concerning this communication or earlier communications from the examiner should be directed to W. David Coleman whose telephone number is 571-272-1856. The examiner can normally be reached on Monday-Friday 9:00 AM - 5:30 PM.

37. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

38. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

W. David Coleman
Primary Examiner
Art Unit 2823

WDC